Request for Information Whitepapers Synopses

(1) Title: Staged Launch and Soft Descent Capability (SLSD)
Author: Robert Adams
MoonStar

Summary:
- Concept: Use a platform tethered to two large airships at 100,000 feet as a launch and recovery base for space transportation systems
  - Could reduce launch costs
  - Provides soft descent, reducing reentry demands on the space transportation system
- Airship and platform could descend to Earth's surface, be replenished with spacecraft, personnel, and supplies, and then returned to 100,000 feet—repeatedly

(2) Title: Lifecycle Engineering
Authors: Tom T. Williams, William C. Anderson, P.E.
United Space Alliance

Summary:
- Concept: "The broad scope and extended life of NASA's future programs demand an up-front strategy for the information management aspects of Life Cycle Engineering."
- NASA should establish a council to define and establish Information Technology standards for NASA and industry
  - Long-term commitment to exploration will incentivize industry to participate
- Necessary for effective implementation of key acquisition enablers like simulation based acquisition and knowledge management

(3) Title: Building a trail of orbital way stations to Mars
Author: John Atcheson
Wyle Labs – JSC Contractor, Bioastronautics

Summary:
- Concept: establish a series of "way stations" in eccentric orbits that cross Mars' orbit and are tangential to Earth's orbit
- Way stations could provide rescue stations and provisioning points
- Way stations could double as science platforms
- Prototype could be tested within Earth-Moon system

(4)Title: Saturn VII
Author: Fred Becker
Private Citizen

Summary:

- Paper presents a clean-sheet launch vehicle capable of annually launching 12-million pounds to LEO and providing annually 910,000 cubic feet of habitable volume in space for $5-billion dollars in operating costs.
- System is TSTO reusable that is recovered at sea.
- The vehicle will be 15 meters in diameter and 75 meters in height and can deliver a payload of 250,000 lbs.

(5) Title: Sustaining Support of American People through Sustainability
Author: Theodore J. Biess
NASA Headquarters, Environmental Management Division

Summary:

- NASA must ensure sustained support of the American public
- Concept: an emphasis on "sustainability"—embedded within all elements of the exploration mission—will respond to societal demands, provide significant spin-offs, and recognize the need to minimize non-renewable resources
  - "The unique design constraints of human space exploration, such as limited energy, closed systems, and limited materials, is an interesting analogy for a world which has increasing resource demands and diminishing resources. If sustainability is embedded into NASA culture, technological solutions created by NASA will have direct crossover to meet societal needs and NASA will have the sustained support from the American people."

(6) Title: Development of an Exploration Transportation System
Author: Jeffery Cardenas
Universities Space Research Association (USRA)

Summary:

- Concept: leverage, harness, and integrate talent from Universities via USRA
  - "USRA has followed with interest the NASA advanced space transportation initiatives and believes the Nation's colleges and universities can and should play a supporting role."
- USRA is a consortium of 95 universities (including some international members)
- Several existing USRA institutes—partnered with NASA centers—could bear on exploration

(7)Title: Highway to the Moon
Authors: Bob Citron, Walter Kistler
Lunar Transportation Systems, Inc. Bellevue, Washington

Summary:
- Concept: refuel reusable spacecraft at locations in cislunar orbit—create 2-way highway
- Reduces cost by using existing EELV capabilities to get crews, supplies to LEO
  - New, reusable spacecraft take crews from LEO to moon and beyond—and then return

(8) Title: Roadmap Comments
Author: Ann Clark
NASA Office of the Chief Scientist

Summary:
- This whitepaper recommends integrating concepts of "sustainability" into each roadmap using the term sustainability as the idea of using resources today to achieve our current needs without compromising the ability of the future generations to meet their needs.

(9) Title: Game Technology Applied to Education in NASA Strategic Roadmap Focus Areas
Authors: William H. Davis, Todd Borghesani,
US Army ARDEC, Executive producer, America's Army Future Applications,
NASA-Sponsered Classroom of the Future, Director of Special Projects

Summary:
- Proposes the use of 3D game technology as a means to link many of NASA's Strategic Roadmap areas to Education and Outreach.
- 3D and other game technologies represent the fastest growing and most engaging, efficient, and cost-effective way to reach out and engage a broad cross section of the country especially students.
- A good example is the representation of Mars surface operations using a 3D game engine. In the gameplay, the adversary could be the environment and one could experience the serious consequences if a helmet is not properly sealed. They could experience first steps on the surface, taking samples, and seeing their shipmates emerge from a spacecraft.

(10) Title: Shuttle Derived Launch Vehicles for Development of an Exploration Transportation system

Authors: Sherman Dupre and others
ATK Thiokal Propulsion, Brigham City, Utah
The Boeing Company, NASA Systems, Houton, Texas
Lockheed Martin Space systems Company—Michoud Operations, New Orleans, Louisiana
United Space Alliance, Houston, Texas

Summary:

- Space Transportation Systems (STS) assets have been in operation since 1981, are well understood from a technical performance, reliability, and operations aspect.
- Concepts are presented that provide a full range of payload capability from 22 to 109 metric tons to near earth orbit and various libration points using existing or modified elements from STS.
- Three basic options are presented: side-mount configuration where the orbiter is replaced with a cylindrical payload carrier, in-line medium/Crew Exploration Vehicle with a new second stage on top of a single solid rocket booster, and in-line heavy with four Space Shuttle Main Engines mounted to the bottom of the external tank with two SRBs attached to it's side and a new upper stage on top.

(11) Title: Hypersonic Aircraft Development

Author: Robert Dyck
Ardeco Areospace, Winnepeg, Canada

Summary:

- Brief description of several options for achieving ETO transportation with reusable hypersonic airbreathing propulsion.
- Starts with NASA's X-43 program and lays out 5 follow-on demonstrators (leading to operational flight) using various combinations of scramjets, plasma, supersonic turbines and rocket based combined cycle technologies.

(12) Title: N2O4 In-Situ Propellant Production

Author: Robert Dyck
Ardeco Areospace, Winnepeg, Canada

Summary:

- The Mars Design Reference mission uses methane and liquid oxygen produced in-situ for propellant. However, liquid oxygen would require either high pressure or regenerative liquefaction for long term storage consuming power. A storable oxidizer is nitrogen tetraoxide. This paper describes a methodology for producing N204 from the Mars atmosphere.

(13) Title: Mini Shuttle Space Taxi
Author: Robert Dyck
Ardeco Areospace, Winnepeg, Canada

Summary:
- Describes a concept for an air launch space taxi using existing aircraft such as the AN-225, Airbus A380F, or a 747 to provide transport of a 4 person crew or small cargo to low earth orbit.

(14) Title: Collapsible Propellant Tank
Author: Robert Dyck
Ardeco Areospace, Winnepeg, Canada

Summary:
- A collapsible propellant tank could provide a low mass compact tank for a Mars Ascent Vehicle fueled by in-situ propellant and provide a small volume for atmospheric entry.
- A single structure could store bi-propellant with a smaller inner bladder. If cryo liquid is stored in the inner bladder and methane in the outer bladder, the methane would act as a thermal mass to stabilize the LOX temperature and help reduce boil-off using a fluoropolymer that is compatible with liquid oxygen and methane.

(15) Title: Collapsible Heat Shield for Aerocapture, Mars and Lunar
Author: Robert Dyck
Ardeco Areospace, Winnepeg, Canada

Summary:
- High purity silica fibre cloth such as the outer layer of Advanced Flexible Reusable Surface Insulation (AFRSI) blankets on the Space Shuttle, can provide a reusable heat shield for Mars aerocapture architecture.
- A heat shield consisting of fabric stretched over a frame could be stored compactly for launch and deployed in space.
- Related to Lunar missions, the collapsible heat shield could be used for aerocapture into Earth orbit upon return and areobraking into low earth orbit.

(16) Title: Tri-propellant Reusable Rocket Engine
Author: Robert Dyck
Ardeco Aerospace, Winnipeg, Canada

Summary:
- A tri-propellant engine (Kerosene/ LH_2/LOX) could improve reusability, lower maintenance and reduce cost
- Kerosene/LOX fuel for the initial boost, and LH_2/LOX for the final flight into orbit
- Russian Company (KBKhA) has already developed such an engine, the RD-701, but US could build new one utilizing latest engine technologies

(17) Title: Fluoropolymer Inflatables for Mars Surface
Author: Robert Dyck
Ardeco Aerospace, Winnipeg, Canada

Summary:
- Fluoropolymers have many benefits making them attractive candidates for inflatable structures for Martian habitation as well as liner for liquid oxygen composite propellant tank
- Each specific polymer has pros and cons; PCTFA is a good compromise of strength, mass, permeability and ductility at low temperature

(18) Title: Spiral Development of a Lunar Heavy Lift Launch Vehicle System
Author: Rebecca A. Farr
NASA Marshall Space Flight Center

Summary:
- Spiral development of a new launch system should leverage some existing Space Transportation System and expendable launch vehicle assets
- Past studies (Shuttle-C for example) based on existing hardware have found extremely capable configuration
- Suggest 1st stage ET-like tank with LOX-Kerosene + 6 redesigned SRMs, 2nd stage modified ET with 3 SSME's or RD180's

(19) Title: Boeing Perspectives on the NASA Space Transportation Strategic Roadmap
Author: Bret Fischer
Boeing

Summary:
- Emphasizes that they believe the commercial industry will not fund any new capabilities at this time given the current market conditions.
- Recommends the NASA baseline for access to space be a combination of Delta IV (modified to deliver 50mT to orbit – using an upperstage which can grow to in-space applications) and non-orbiter elements of the Space Shuttle; while providing on-ramps for entrepreneurial ventures.
- Postulates that developing on-orbit automated rendezvous and docking capability is "much less challenging" than building a new heavy lift launch system.
- Recommends NASA utilize a Commercial Launch Systems Integrator to provide a broad range of National launch capabilities.

(20) Title: Developing Effective Earth to Orbit Transportation
Author: Al Globus
CSC at NASA Ames Research Center

Summary:
- Concept: $5.6 billion prize program to create a robust human-capable Earth-to-orbit transportation system. (Amount is about one year's shuttle operations.)
- Pay out using declining scale, $ 100M for first 10 people launched and safely returned, $ 90M for next 10 and so on down to $10K for the last 1000.
- Structure competition for at least two competitors (not winner take all) and to ensure safety

(21) Title: GEODE— Commercial/Industrial Process & Applications Platform: CIPAP
Author: Mark Holderman
NASA Johnson Space Center

Summary:
- Proposes to use ET's to build in space a commercially controlled industrial facility that directly manufactures products.
    - Need a production facility to get commercial interest
    - Need to protect proprietary data/processes
    - Processes developed for space environment—can't simply do terrestrial processes (1g) in space.
    - Need to develop products that require manufacture in space environment, will make so that customers become completely dependent on the unique and exclusive environment of near-Earth-orbit.
- The focus of the CIPAP p/m is to provide a standardized means for Corporate America and Academia to readily and easily utilize the space environment. Time spent on-orbit will vary as each CIPAP p/m will have specific duration requirements.

(22) Title: Integrated Health Monitoring Sensor Suite for Space Exploration Vehicles
Authors: Dr. Stephen W. Allison, Dr. Daryush Ila, Dr. William A. Hollerman,
Oak Ridge National Laboratory, Oak Ridge, Tennessee
Alabama A&M University Research Institute, Normal, Alabama
University of Louisiana at Lafayette, Lafayette, Louisiana

Summary:
- Propose to develop an integrated system that is capable of monitoring key parameters, including temperature, pressure/impact, surface erosion, and ionizing radiation using phosphor-based sensors.
- The sensor suite will monitor the health of any space vehicle or structure with minimal mass and electrical impact and could be directly integrated into a smart composite material or structure.
- This technology has the advantage of no direct electrical connections that could lead to spacecraft charging or field effects.

(23) Title: Project Bonaventure
Author: Jeffery H. Kavanaugh
Capital Area Astronomy Association

Summary:

- Propose to develop a liquid methane fueled lifting body space transportation system typically operated unmanned; however, manned operations would be accomplished through the addition of a palletized Personnel Transportation Subsystem similar in concept to the GE Apollo proposal or Russian Soyuz.
- The air breathing propulsion system is a hybrid aerodynamically valved Pulse Detonation Engine (under development by GE), combined with a Supersonic Combustion Ramjet. Liquefied Methane is the assumed fuel.

(24) Title: In Situ Crew Mission Objectives Planning and Scheduling
Author: Christopher Leslie
United Space Alliance

Summary:

- Paper describes the use of central technology to allow crew to schedule mission operations (daily plan) on their own (versus reliance on mission operations directorate)
- Technology to support planning process would include consideration of activities to be performed, crew time, instructions, power, daylight constraints, communication opportunities and/or tools and supplies.
- Crew will need to know what the objectives are, what the constrains are, what the resource are and those resource will be available.

(25) Title: Sounding Rockets in the 21st Century – Strategic Enhancement of a Core Capability to Mitigate Risk and Cost in the NASA vision for Space Exploration
Author: Stephan R McCandliss – Ph.D.
Johns Hopkins University

Summary:

- Paper describes use of sounding rockets in sub orbital missions to develop new technology
- Invest in a high altitude delivery stem to increase exo-atomospheric time to 40 minutes

(26) Title: Independent Space System Operator concept
Author: Carey McCleskey
NASA Kennedy Space Center

Summary:
- Paper describes the use of an independent operator to process hardware provided by the flight system manufacturers (i.e. independent operator of Boeing, LMCO, Shuttle, etc launch vehicles)
- The concept enables the independent operator to build a portfolio of flight and ground equipment assets that can be used efficiently
- The paper recommends that ESMD compete a contract for independent operators
- The paper suggest he use of independent operation for any evolved EELV and/or derived flight operations
- The paper recommends that a group be chartered to search for potential government and commercial independent operators

(27) Title: Demonstration Missions for In-Space Assembly
Author: Chris Miller
United Space Alliance

Summary:
- Demonstration mission for in-space assembly
- Demonstrations of modular in-space assembly designs
- System analyses for primary structure, subsystem, and assembly scenarios
- Paper recommends solicitation for On-Orbit Testbed Operations Contractor

(28) Title: Develop an Exploration Transportation System
Author: Not Provided
Constellation Services International, Inc.

Summary:
- Paper describes us of Earth / Moon Lagrange points for staging for lunar missions
- Progress class vehicle (space tug) to provide pressurized volumes, tankage for propellant, and communication and attitude control
- Medium lift launcher to lift the tug (Atlas, Delta or Proton)

(29) Title: Super conducting Electromagnetic Launch Assist Technology
Author: S. Mustafi and E.R. Canavan
NASA Goddard Space Flight Center

Summary:
- Paper describes us of Electromagnetic Launch Assist (ELA) system in conjunction with a two-stage scramjet/rocket vehicle to deliver payload to orbit
- ELA to provide first segment acceleration to Mach 2, Scramjet to provide second segment
- Super conducting maglev system, with superconductor magnetic energy storage and power distribution and control is enabling technology.
- Paper references discovery of high temperature superconductivity (HTS) material

(30) Title: Heavy Lift Launcher vs On-Orbit Assembly of ETS
Author: C. Ower and T. Reedman
MDRobotics

Summary:
- An alternative to building a new heavy launch vehicle is more frequent flights of the existing ELV family of vehicles with attendant increased on-orbit assembly
- Pros and cons are outlined for both approaches, but essentially they boil down to the high cost of development of a super-heavy ELV versus the investment in technology and logistical complexities of large scale on-orbit assembly
- Greater operational flexibility and tolerance to launch failures is a hallmark of using existing launch vehicles at a higher launch rate

(31) Title: Internet Compliant Expendable Launch and Satellite Vehicles
Author: Philip Paulsen
Glenn Research Center

Summary:
- Increased operational efficiencies from common communication architecture can reduce standing army costs (elimination of conflicting interfaces and formats)
- Potential for substantial improvements in data handling and distribution across ground and space borne systems
- Use of a common internet protocol interface has potential to reduce overall mission lifecycle costs according to studies performed for GRC
- Has been demonstrated in limited experiments to date (CHIPsat)

(32) Title: Virtual Mission Operations Suite for Secure Command and Control of Expendable Launch and Satellite Vehicles
Author: Philip Paulsen
Glenn Research Center

Summary:
- Concept of a Virtual Mission Operations Center (VMOC) that allows for a more distributed operational approach (remotely located operators) for ground and space operations
- Builds on and requires the IP common interface initiative
- Chief advantages are reduced operational staff, increased security and increased tolerance to system failures
- Limited VMOC operational demonstrations are already underway with test satellites

(33) Title: Figures of Merit for Development of Exploration Transportation Systems
Author: Scott Horowitz
ATK Thiokol Inc

Summary:
- Asserts that the two primary driving needs for transportation are ISS and Exploration Transportation (explained as crew and large cargo). *Note: no acknowledgement of other Agency space lift needs.
- Establishes the case for developing Figures of Merit (FOM) with which to evaluate launch options
- Uses examples such as reliability of the combined launcher and abort strategy, number of launches to accomplish missions, and number of stages/engines to demonstrate the concept

(34) Title: Launch Vehicle Reliability and Survivability
Author: Mark Tobias
ATK Thiokol Inc

Summary:
- Establishes a position that traditional reliability analyses are inadequate in that they fail to consider integrated vehicle considerations (vs a component by component approach) and sites trajectory design as an example of an influence on reliability.
- Discusses the use of groupings of failure modes into scenarios, the idea being that the end results are similar enough to warrant this approach
- Proposes an alternate methodology for calculating reliability based on combat aircraft survivability, defining the loss of crew as the product of a probability of a failure and the probability of loss of crew given a failure
- Frequently uses the example of the inline CEV architecture to illustrate the approach

(35) Title: Crew Exploration Vehicle Escape Propulsion Approach
Author: Larry Johnson
ATK Thiokol Inc

Summary:
- Ability of future manned vehicles to have a crew escape capability is a key safety enhancing feature, and should be a must based on lessons learned from STS
- Establishes key attributes of an abort system rocket motor, and makes the case that only solids can perform this adequately

(36) Title: Launch Facility Options for Shuttle-derived Launch Vehicles
Author: Larry Johnson
ATK Thiokol Inc

Summary:
- Byline is that the use of existing launch infrastructure assets is the key to affordable access to space
- Advocates an in-line architecture utilizing the STS RSRM as a first stage with a cryo 2nd stage (studied and proposed for some time) as a way to leverage existing launch infrastructure to the benefit of STS and Exploration operations (known as the single-stick option)
- Rudimentary integrated STS/CEV schedule leading to a demo launch of a ”single-stick” in 12/08
- An alternate option is proposed of using CX40, following the final Titan IV flight

(37) Title: Vehicle Sizing Optimization
Author: Larry Johnson
ATK Thiokol Inc

Summary:
- Proposing that elements of the STS can be used in an innovative common-component architecture to develop a family of vehicles that supports both earth-to-orbit and translunar injection (TLI) mission in a spiral development fashion
- Focusing on minimizing development costs, maximizing reliability and reducing recurring costs
- Spiral 1: Develop initial CEV launch vehicle (SRB Stick) and heavy lift for cargo (ET In-Line) with a common upper stage
- Spiral 2: Enhanced version of the upper stage to perform the TLI function – TLI and 2nd stage are the same
- Spiral 3: Reducing Recurring Cost – implement cost saving approaches into manufacturing (ex. Expendable SSMEs)

(38) Title: Exploration Transportation System for Exploration Initiative
Author: Don Sauvageau
ATK Thiokol Inc

Summary:
- Exploration heavy lift transportation concepts (both crew and cargo) that use the propulsion backbone of the current Space Transportation System (STS)
- Heavy Cargo:
    - Sidemount concept – replace the current orbiter with a cargo carrier and utilize 5-segment SRBs
    - In-Line Concept – ET stretched core with payload on top (in- line); 5-segment SRBs
- Crew Vehicle:
    - SRB Single Stick to carry crew on top
    - CEV can be replaced with payload shroud to carry 48K lbs of cargo

(39)Title: Aeronautics Strategic Objective White paper
Author: W. Ray Morgan
Morgan Aircraft Consulting

Summary:
- Proposing the development of a space launch system with an air-breathing hypersonic first stage as a promising way to meet affordability challenges
- Autonomous controlled first stage vehicle accelerates a payload and upper stage to Mach 6.
- Launches vertically using afterburning turbojet engines and accelerates itself to Mach 2.5 between 50, 000 feet and 70, 000 feet, converts to ramjet propulsion then accelerates to Mach 6 at 100, 000 to 150, 000 feet

(40) Title: Development of an Exploration Transportation System
Author: Jeff Siders
United Space Alliance

Summary:
- Use a variety of Shuttle –derived launch vehicles to implement the Exploration Initiative
- Provides a cost-savings by utilizing common infrastructure
- Three proposed options:
    - Enhanced Shuttle Transportation System – current Shuttle system with applicable new technologies and efficiencies to reduce costs
    - In-Line Carrier (ILC) – Human-rated four-segment SRB as the first stage with a human rated J2S engine as the second stage
    - Sidemount Carrier (SMC) – Evolution of the current STS; current SSMEs, Super Lightweight Tank (SLWT), 4-segment SRBs. Orbiter is replaces with a 6.5 meter diameter by 25 meter length wingless cargo carrier

(41) Title: Counter measure Development for the Radiation Risks for Space Travelers
Author: Donald M. Strayer, Charles Hays
Jet Propulsion Laboratory - Caltech

Summary:
- Proposing measures to reduce effects of exposure to ionizing radiation – Active shielding using large magnetic fields generated by super conducting magnets
- Applying large magnets to simulate planetary gravity levels for testing subsystem components (ex. Heat exchangers and liquefiers) on earth but simulating a relevant environment

(42) Title: Decision Methods for Matching Booster Capacity to Payloads, etc
Author: John K. Strickland, Jr
National Space Society

Summary:
- Objective is to reduct per mission cost of lunar, Mars missions over program lifetime
- Bases for decision are listed
- The author also discusses: ordering of necessary decisions (sample provided), examples of primary mission design axes for decision analysis, scenario analysis, and impacts of one decision on another design aspect

(43) Title: A Proposal to Re-evaluate All Materials Submitted during OUTREACH90
Author: John Strickland, Jr.
National Space Society

Summary:
- All of the suggestions that were submitted by individuals and groups during the 1990 Outreach should now be re-evaluated for ideas on the new Exploration plans
- The AIAA Document was titled: FINAL REPORT TO THE OFFICE OF AERONAUTICS, EXPLORATION AND TECHNOLOGY, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ON ASSESSMENT OF TECHNOLOGIES FOR THE SPACE EXPLORATION INITIATIVE (SEI), DECEMBER 31, 1990

(44) Title: Issues of Technology Obsolescence and Knowledge Base Attrition
Author: Eric Hogan
Lockheed Martin

Summary:
- Discusses a potential solution to the problem of system obsolescence/knowledge loss given the length of time between lunar and Mars spirals.
- Recommends a modification to the current spiral definition where Mars missions are interleaved between lunar missions providing smaller gaps between initial lunar use and Mars application. Discusses how each element could more readilly applied to the next spiral.
- Spiral 3 would become a Mars flyby, Spiral 4 would be an extended lunar stay and Spiral 5 would remain a Mars surface mission.

(45) Title: Minimum Size for ETO Transportation
Author: Eric Hogan
Lockheed Martin

Summary:
- Overarching recommendation is to limit the number of launches for any given human lunar mission to no more than 6 flights.
- Recommends sharing launch infrastructure between NASA and DOD.
- Discusses several reasons: infrastructure limits, mission reliability, mission duration, recovery from failures and effectiveness.

(46) Title: A National Perspective
Author: Eric Hogan
Lockheed Martin

Summary:
- Overarching recommendation is that the USG should pursue space transportation at the National level – particularly launch for NASA, USAF and NRO
- Discussion on how the overall reliability, robustness and margins could be increased and cost could be decreased from utilizing common elements/systems across multiple agency missions.

(47) Title: Propulsion and Stages
Author: Eric Hogan
Lockheed Martin

Summary:
- Overarching recommendation is that NASA develop the minimum number of required space transportation elements, especially engines.
- Recommends that NASA limit its investment in new chemical propulsion technology. Specifically recommends that NASA utilize the an existing engine/engine suite (e.g., RL-10) for Trans-Lunar Injection, Trans-Earth Injection and Lunar Orbit Insertion and focus new development on ascent/descent propulsion.

(48) Title: Modular contingency and redundancy development two person "mini-stations"
Author: Paul Torrance
Johnson Space Center

Summary:
- Modular approach for human habitation and transport beyond low Earth orbit.
- Two person mini-stations can be combined together to form macro-stations and crew transport, small and large space stations for any planetary body, and also be used for inter-planetary transport, and lunar and Mars habitats
- Competitive process with continuous improvement
- Mass-production and cost control would allow for complete, independent contingency planning built into the design (an Apollo 13 lesson)

(49) Title: Strategic Centennial Earth to LEO "Contingency" Developmental Program
Author: Paul Torrance
Johnson Space Center

Summary:
- Award three or four rocket booster corporations the booster portion
- Award two or three corporations the human transport module portion
- Use "Universal" connection and joint between the lower rocket and upper human transport to allow competitive procurement and continuous competitive process improvement
- Attempt to manufacture proposed designs using off-the-shelf hardware and mature propulsion systems
- Destructively test proposed designs until confidence is established regarding the probability of passenger survival
- Continuously improving procurement specification for the booster and the human transport crew survival, escape, and rescue system would continually decrease both the probability of fatality and cost of production
- Attempt to end the tradition of pre-flight review with this new vehicle

(50) Title: Electromagnetic Launch Assist
Author: Michael Wright
Goddard Space Flight Center

Summary:
- Exploration surface-to-orbit transportation concept (both crew and cargo) utilizing electromagnetic forces as an assist to chemical rocket propulsion
- Magnetic levitation and linear motor technologies in use in current Earth transportation systems
- Accommodates various vehicle configurations (allows for vehicles w/safe return of crew)